



MASTER'S DEGREE IN BIOMEDICAL RESEARCH

Research Project Proposal

Academic year 2023-2024

Project Nº 09

Title: Design, synthesis and application of novel hydrogels for cardiovascular tissue engineering

Department/ Laboratory

Cima Lab 1.01 and Dptm of Pharmaceutical Technology and Chemistry

Director 1 Manuel Mazo

Contact: mmazoveg@unav.es

Codirector: Daniel Plano

Contact: dplano@unav.es

Summary

Advancement towards the *in vitro* fabrication of bioartificial tissues relies heavily on developing new materials capable of supplying a 3D structure to cells. Being one of the most promising types of materials, physical properties-tuneable hydrogels rely on external stimuli, be it light irradiation of chemical initiators, to form a crosslinked network. Chemical modification of natural polymers arises to provide strategies capable of tailoring the final biomaterial properties to the desired application, retaining good biocompatibility. **This project aims at synthesising and characterizing a library of natural-based hydrogels able to crosslink under biocompatible conditions and amenable to 3D printing and bioprinting.** Next, capacity to form gels will be assessed, as well as biocompatibility with different cell types. On a step forward towards the generation of cardiac engineered tissues, human induced pluripotent stem cells (hiPSCs) will be differentiated to cardiomyocytes (CMs) through small molecule-based modulation of the Wnt pathway. hiPSC-CMs will be isolated, and biocompatibility tested with the new hydrogels. Next, capacity to form self-standing beating constructs will be determined. Finally, to better comply with the natural properties of cardiac tissue, scaffolds will be 3D printed using melt electrowriting (MEW), a 3D printing technology with the capacity to print the smallest fibres. hiPSC-CMs will be embedded in the biorthogonal hydrogels and crosslinked on the MEW scaffolds, with different architectures. Throughout the project, the candidate will acquire training on chemical synthesis, cell biology, hiPSC culture and differentiation, MEW, as well as a range of analytical techniques, including RT-qPCR, IF, FACS and confocal microscopy amongst others. A highly interdisciplinary thinking capacity and self-motivation is required for this enterprising project.

yes	x
no	

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?